

**WHAT IS CLAIMED IS:**

1. A method for single molecule identification of a target DNA molecule in a random coil state comprising the following steps:
- a) attaching an optically distinguishable material to a DNA sequence recognition unit;
  - b) hybridizing said DNA sequence recognition unit to said target DNA molecule in a random coil state to form a hybridized DNA complex in a random coil state;
  - c) passing said hybridized DNA complex in a random coil state from a reservoir in a microfluidic device through a narrow channel to cause an acceleration of flow through said channel, thereby causing said hybridized DNA complex to extend into a substantially linear configuration; and
  - d) detecting said optically distinguishable material in a sequential manner along said substantially linear hybridized DNA complex, thereby identifying said target DNA molecule.
2. The method of claim 1 wherein said optically distinguishable material comprises colored microparticles.
3. The method of claim 1 wherein said optically distinguishable material comprises microparticles having different shapes.
4. The method of claim 2 wherein said colored microparticles comprise dyes, dye aggregates, pigments or nanocrystals.
5. The method of claim 1 wherein said DNA sequence recognition unit comprises DNA, DNA fragments, synthetic oligonucleotides or peptide nucleic acids.

6. The method of claim 1 wherein said DNA sequence recognition units comprise any protein scaffold or synthetic molecular moiety capable of recognizing a specific DNA sequence.

5 7. The method of claim 1 wherein said narrow channel of said microfluidic device has a width or depth of from about 0.1  $\mu\text{m}$  to about 500  $\mu\text{m}$ .

8. The method of claim 1 wherein said narrow channel of said microfluidic device has a width or depth of about 1  $\mu\text{m}$  to about 300  $\mu\text{m}$ .

10 9. The method of Claim 1 wherein said microfluidic device is fabricated by photolithography, dry plasma etching, wet chemical etching, laser ablation, air abrasion, injection molding or embossing.